EXHIBIT F

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審査請求　未請求　（全　頁）

⑭考案の名称　熱交換器

⑳実　願　昭62－50273

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明　　細　　書 (3)

1．考案の名称

熱　交　換　器

2．実用新案登録請求の範囲

アルミニウム押出型材製の筒形枠(2)と、両面にフィン(4)を有する仕切板(3)とよりなり、筒形枠(2)の左右の内面に嵌合用凹溝(7)(7)が枠(2)の一端開口部より他端開口部まで全長にわたってかつ互いに対向状に設けられ、フィン付き仕切板(3)の左右両側縁部が枠(2)内面の嵌合用凹溝(7)(7)にそれぞれ嵌め込まれて、筒形枠(2)の内部にフィン付き仕切板(3)を介して2つの流体流路(11)(12)が形成されている熱交換器。

3．考案の詳細な説明

産業上の利用分野

この考案は、例えば密閉式制御盤等に取り付けられる熱交換器に関するものである。

従来の技術

一般に、密閉式制御盤において電動機制御用

のサイリスタ等の半導体素子を収納したキュービクルは、内部の熱ロスによって昇温するが、この種の半導体では最高許容温度が決められているため、熱を放散して内部を冷却しなければならない。熱を放散するには、外気によって内部を冷却するのが最も簡単でかつ効率が良いが、外気には塵芥類が含まれているため、これを取込むと塵芥類が制御装置に付着して、絶縁性を損なうおそれがあった。そこでキュービクル内部を外気と完全に遮断しかつ効率よく熱交換を行ない得る熱交換器が要望されている。

このような熱交換器としては、従来例えば第8図に示すように、横断面浅い⊔形の一対のカバー(21)(22)と、両面に左右立上がり壁(24)(25)およびこれらの間の並列状フィン(26)をそれぞれ有するアルミニウム押出型材製の仕切板(23)とによって構成され、カバー(21)(22)の左右両側壁(21a)(21a)(22a)(22a)が仕切板(23)両面の左右立上がり壁(24)(25)にそれぞれビス(27)で取り付けられることにより、一対のカバー(2

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1)(22)によって囲まれかつ仕切板(23)により区分された２つの流体流路が形成され、さらに内側カバー(21)と外側カバー(22)の中央部にあけられた吸気孔(29)(29)にそれぞれ吸気ファン(28)(28)がのぞませられたものが知られている。このような従来の熱交換器は、制御盤のキュービクルの側壁にその一方の流体流路を内側に、他方の流体流路を外側にして取り付けられ、２つのファン(28)(28)の作動により一方のキュービクル内部の清浄空気が吸気孔(29)より導入され内側流体流路を通過して、キュービクル内を循環せしめられ、他方外気が別の吸気孔(29)より導入され外側流体流路を通過することにより、キュービクル内部の清浄空気の保有熱がフィン(26)付き仕切板(23)を介して外気に伝達されて放散せしめられるようになされていた。

しかしながら、このような従来の熱交換器は、構成部品数が非常に多く、その製造が容易でなく、かつコストが高くつくうえに、重量が重く、制御盤のキュービクルの側壁に長期間取り付け

た場合、側壁に反りを生じるという問題があった。

考案の目的

この考案の目的は、上記の従来技術の問題を解決し、熱交換性能がすぐれていて、しかも軽量であり、また部品数が非常に少なく、その製造を容易かつ安価になし得る熱交換器を提供しようとするにある。

考案の構成

この考案は、上記の目的を達成するために、アルミニウム押出型材製の筒形枠と、両面にフィンを有する仕切板とよりなり、筒形枠の左右の内面に嵌合用凹溝が枠の一端開口部より他端開口部まで全長にわたってかつ互いに対向状に設けられ、フィン付き仕切板の左右両側縁部が枠内面の嵌合用凹溝にそれぞれ嵌め込まれて、筒形枠の内部にフィン付き仕切板を介して2つの流体流路が形成されている熱交換器を要旨としている。

実施例

つぎに、この考案の実施例を図面に基づいて説明する。

この明細書において、左右は第５図を基準とし、左とは第５図図面紙葉の表側、右とは同裏側をいい、また内側とは密閉式制御盤のキュービクルの内側、外側とは同外側をいうものとする。

この考案を密閉式制御盤の放熱器に適用した実施例を示す第１図～第５図において、この考案による熱交換器（放熱器）(1)は、横断面略矩形のアルミニウム押出型材製の筒形枠(2)と、表裏両面に切り起こされて形成された多数の舌状フィン（スカイブ・フィン）フィン(4A)を有する仕切板(3)とによって構成されている。筒形枠(2)の左右両側壁(5)(5)の幅中央部内面に、一対の互いに平行な凸条(6)(6)と、両者の中間の嵌合用凹溝(7)(7)がそれぞれ枠(2)の一端開口部より他端開口部まで全長にわたってかつ互いに対向状に設けられている。上記フィン付き仕切板(3)が枠(2)内にその左右両側縁部をそ

れぞれ嵌合用凹溝(7)(7)に嵌まり込むように枠(2)の一端開口部より挿入されて、筒形枠(2)の内部にフィン付き仕切板(3)を介して2つの流体流路(11)(12)が形成されている。

筒形枠(2)の内外両側壁(8)(8)の中央部にそれぞれ吸気孔(9)(9)があけられ、これらの吸気孔(9)(9)にのぞませられるようにファン(13)(13)がそれぞれ枠(2)の内外両側壁(8)(8)にビス(図示略)により取り付けられている。

また筒形枠(2)の左右両側壁(5)(5)の外面幅中央部に取付用張出壁(10)(10)がそれぞれ外方に伸びるようにかつ枠(2)の全長にわたって設けられている。仕切板(3)の両端部(3a)(3a)はフィン(4A)が無く、かつ筒形枠(2)の両端開口部より外方に突出せしめられていて、筒形枠(2)の取付用張出壁(10)(10)、並びに仕切板(3)の両端部(3a)(3a)のそれぞれ制御盤キュービクル(15)側の面にウレタンフォームよりなるガスケット(14)(14)が取り付けられている。筒形枠(2)の左右両側の取付用張出壁(10)にはガスケッ

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ト(14)と一致して多数のビス挿通用切欠(16)が所定間隔おきに設けられ、仕切板(3)の両端部(3a)(3a)にはガスケット(14)と一致してビス挿通孔(17)があけられている。

第5図に示すように、上記熱交換器(1)は制御盤のキュービクル(15)の側壁(18)にあけられた開口部(19)にその内側流体流路(11)部分が嵌まり込むようにしてキュービクル(15)に密接状に取り付けられている。熱交換器(1)の内側流体流路(11)はキュービクル(15)の内部に通じており、内外一対のファン(13)(13)が作動すると、キュービクル(15)内の清浄でかつ高温の空気は内側ファン(13)により筒形枠(2)の内側壁(8)中央部の吸気孔(9)より吸い込まれて内側流体流路(11)を通過し、この間その保有熱が多数の舌状フィン(4A)および仕切板(3)に伝達される。一方、低温の外気は外側ファン(13)により筒形枠(2)の外側壁(8)中央部の吸気孔(9)より吸い込まれて外側流体流路(12)を通過し、この間仕切板(3)および多数の舌状フィン(4A)を介し

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てキュービクル(15)内の清浄空気の保有熱が外気に伝達せしめられる。熱を放出して冷却された清浄空気は内側流体流路(11)の両端開口部よりキュービクル(15)内を循環せしめられ、逆に熱を奪って加温された外気は外側流体流路(12)の両端開口部より外部に放散せしめられる。

上記実施例によれば、熱交換器(1)はアルミニウム押出型材製の筒形枠(2)と、両面に切り起こされて形成された多数の舌状フィン(4A)を有する仕切板(3)とによって構成されているので、部品数が少く、その製造を容易かつ安価になし得るとともに、熱交換性能が顕著にすぐれており、またきわめて軽量である。

第6図は、この考案による熱交換器(1)のフィン付き仕切板(3)の変形例を示すものである。ここで、仕切板(3)はアルミニウム・ブレージング・シートによりつくられ、これの両面に平面よりみてジグザグ状の山形部を有するいわゆるマルチエントリー型のコルゲート・フィン(4B)(4B)が接合されている。なお、仕切板(3)は

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アルミニウム・プレージング・シートよりなり、かつコルゲート・フィン(4B)(4B)はアルミニウム板をプレス加工することによりつくられているものであるため、この変形例のフィン(4B)付き仕切板(3)はきわめて軽量である。

第7図は、フィン付き仕切板のいま1つの変形例を示すものである。ここで、仕切板(3)と、これの両面に設けられた並列状のフィン(4C)とはアルミニウム押出型材によりつくられている。

上記第6図と第7図の変形例のフィン付き仕切板(3)は、前記実施例のアルミニウム押出型材よりなる筒形枠(2)とそれぞれ組み合わせて、熱交換器(1)を同様に構成し得るものである。

なお、仕切板(3)の両面に設けられるフィン(4)の形状は、図示のものに限らず、その他のものであっても勿論よい。また図示の筒形枠(2)は、横断面略矩形であるが、これは横断面円形、楕円形等の形状を有していてもよい。

また上記実施例においては、この考案の熱交換器を密閉式制御盤の放熱器として使用した場

合を示したが、これに限らず、この考案はその他種々の熱交換器に適用可能である。

考案の効果

この考案による熱交換器は、上述のように、アルミニウム押出型材製の筒形枠(2)と、両面にフィン(4)を有する仕切板(3)とよりなり、筒形枠(2)の左右の内面に嵌合用凹溝(7)(7)が枠(2)の一端開口部より他端開口部まで全長にわたってかつ互いに対向状に設けられ、フィン付き仕切板(3)の左右両側縁部が枠(2)内面の嵌合用凹溝(7)(7)にそれぞれ嵌め込まれて、筒形枠(2)の内部にフィン付き仕切板(3)を介して2つの流体流路(11)(12)が形成されているもので、部品数が非常に少なく、その製造を容易かつ安価になし得るとともに、熱交換性能がすぐれているという効果を奏する。また両面に切り起こされて形成された舌状フィン(4A)あるいはコルゲート・フィン(4B)を有するフィン(4)付き仕切板(3)を使用すれば、きわめて軽量になるという利点がある。

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４．図面の簡単な説明

図面はこの考案の実施例を示すもので、第１図は本考案品の斜視図、第２図は部分切欠き側面図、第３図は同平面図、第４図は筒形枠のみの正面図、第５図は本考案品の使用状態を示す部分切欠き側面図、第６図はフィン付き仕切板の変形例を示す部分斜視図、第７図は同じくいま１つの変形例を示す部分斜視図である。第８図は従来例を示す分解斜視図である。

(1) …熱交換器、(2) …筒形枠、(3) …仕切板、(4)(4A)(4B)(4C) …フィン、(5)(5)…左右側壁、(7) …嵌合用凹溝。

以　上

実用新案登録出願人　昭和アルミニウム株式会社

代　理　人　岸本　瑛之助　（外

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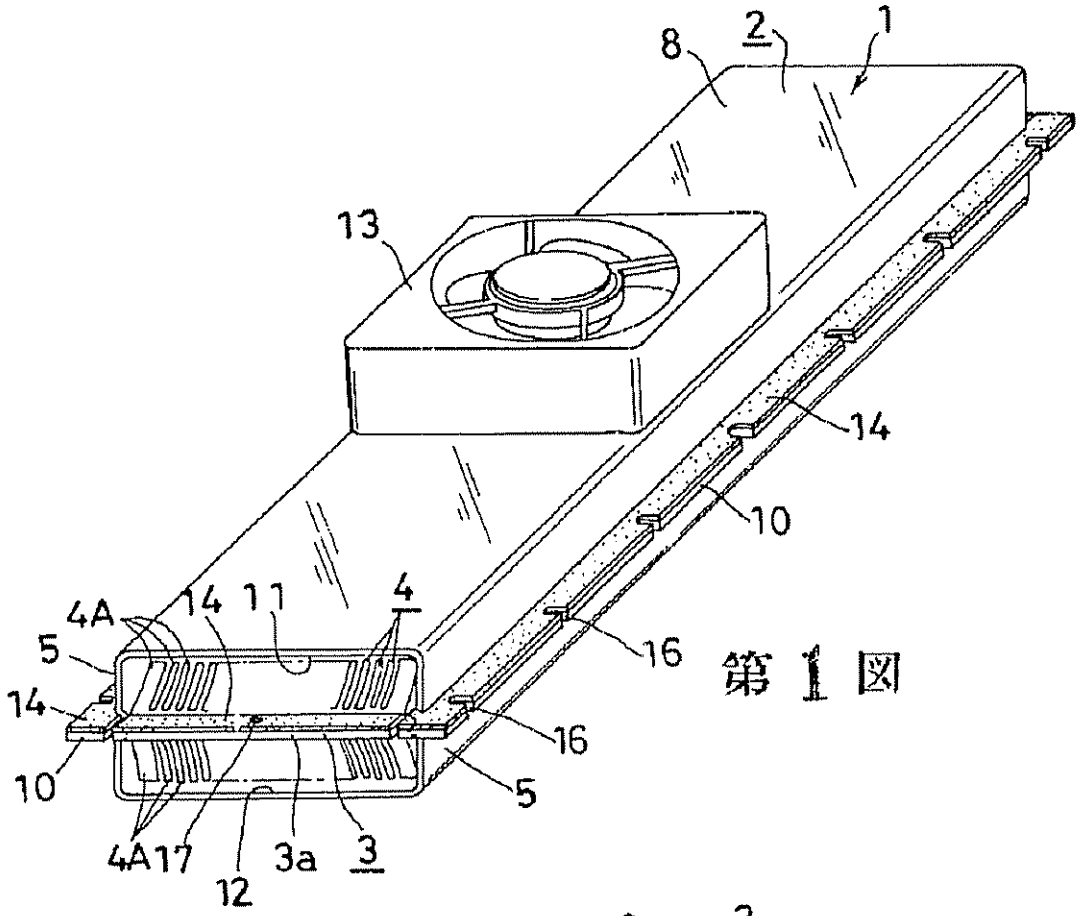
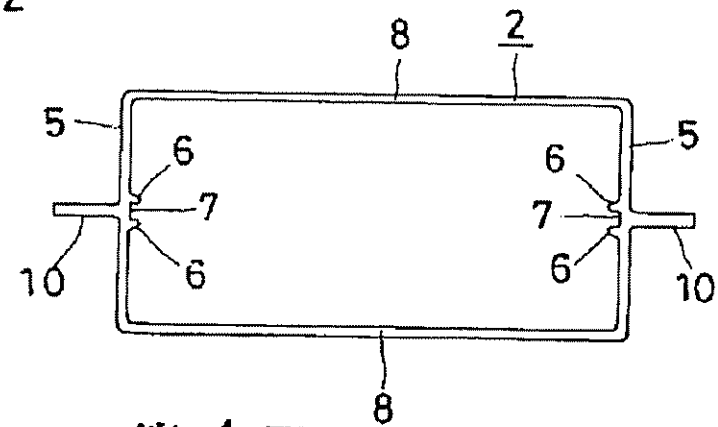


第1図



第4図

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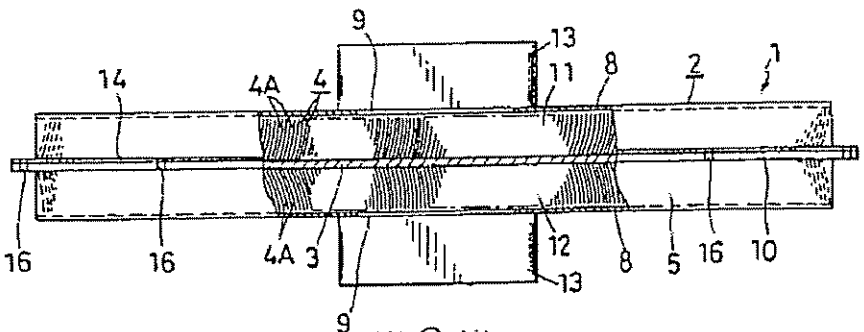
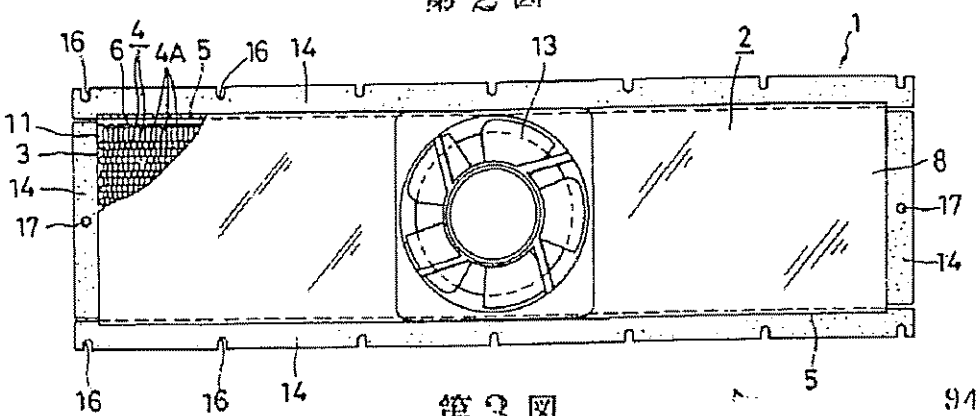


第2図



第3図

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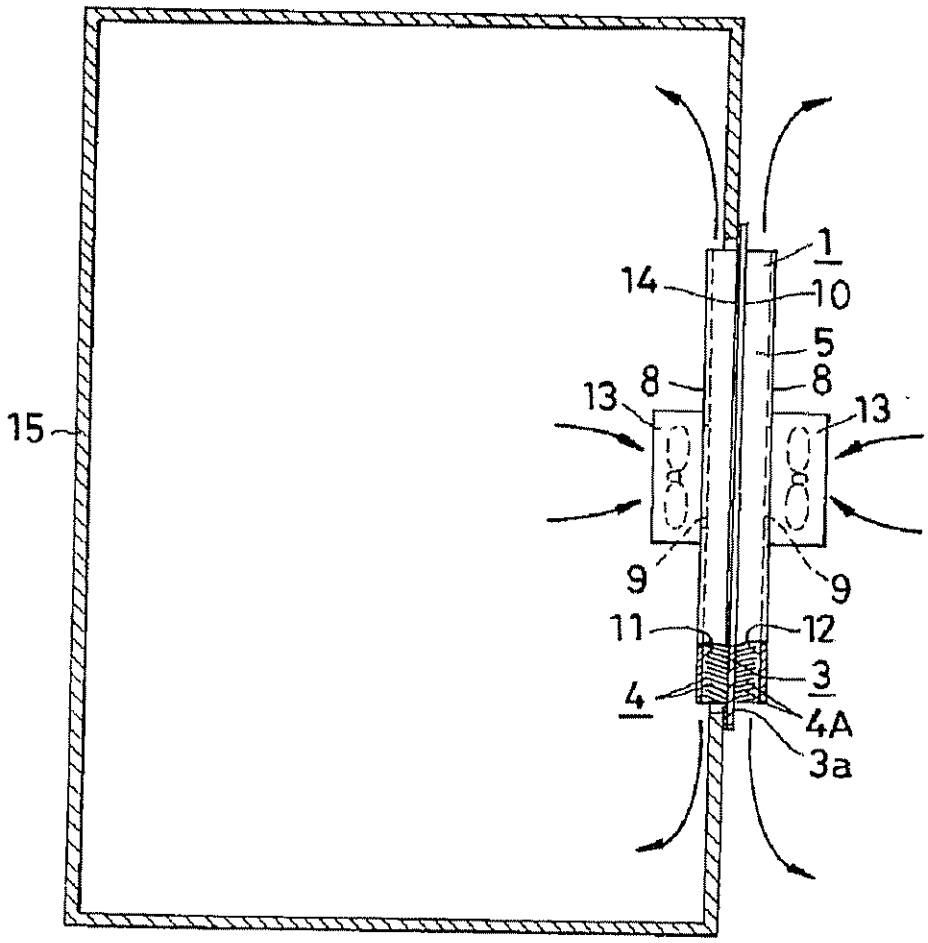
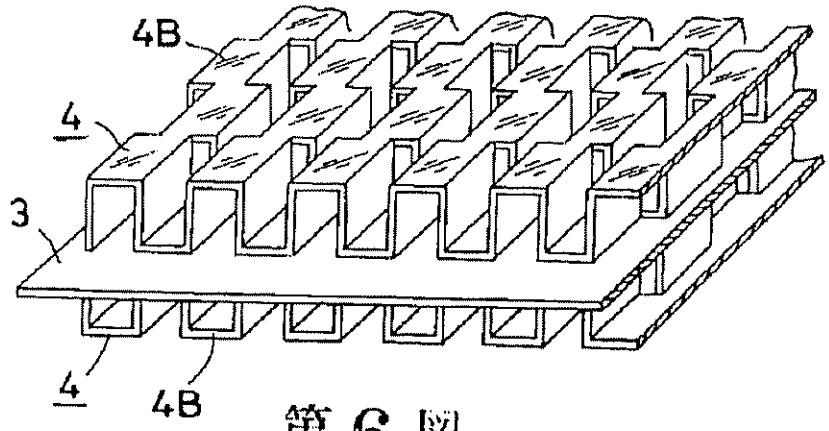


第5図



第6図

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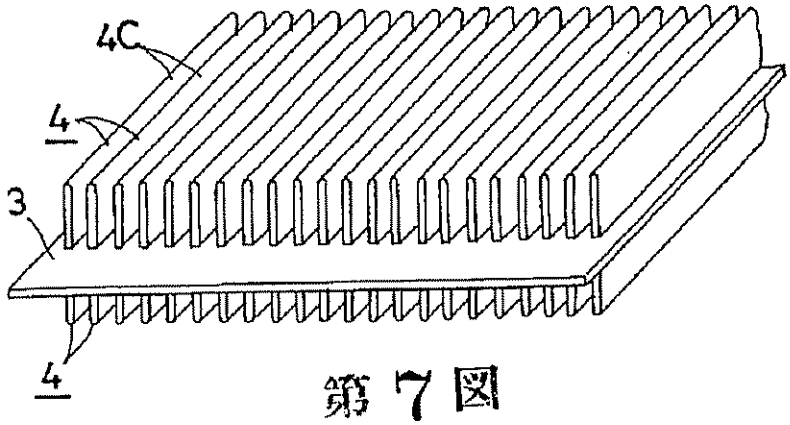
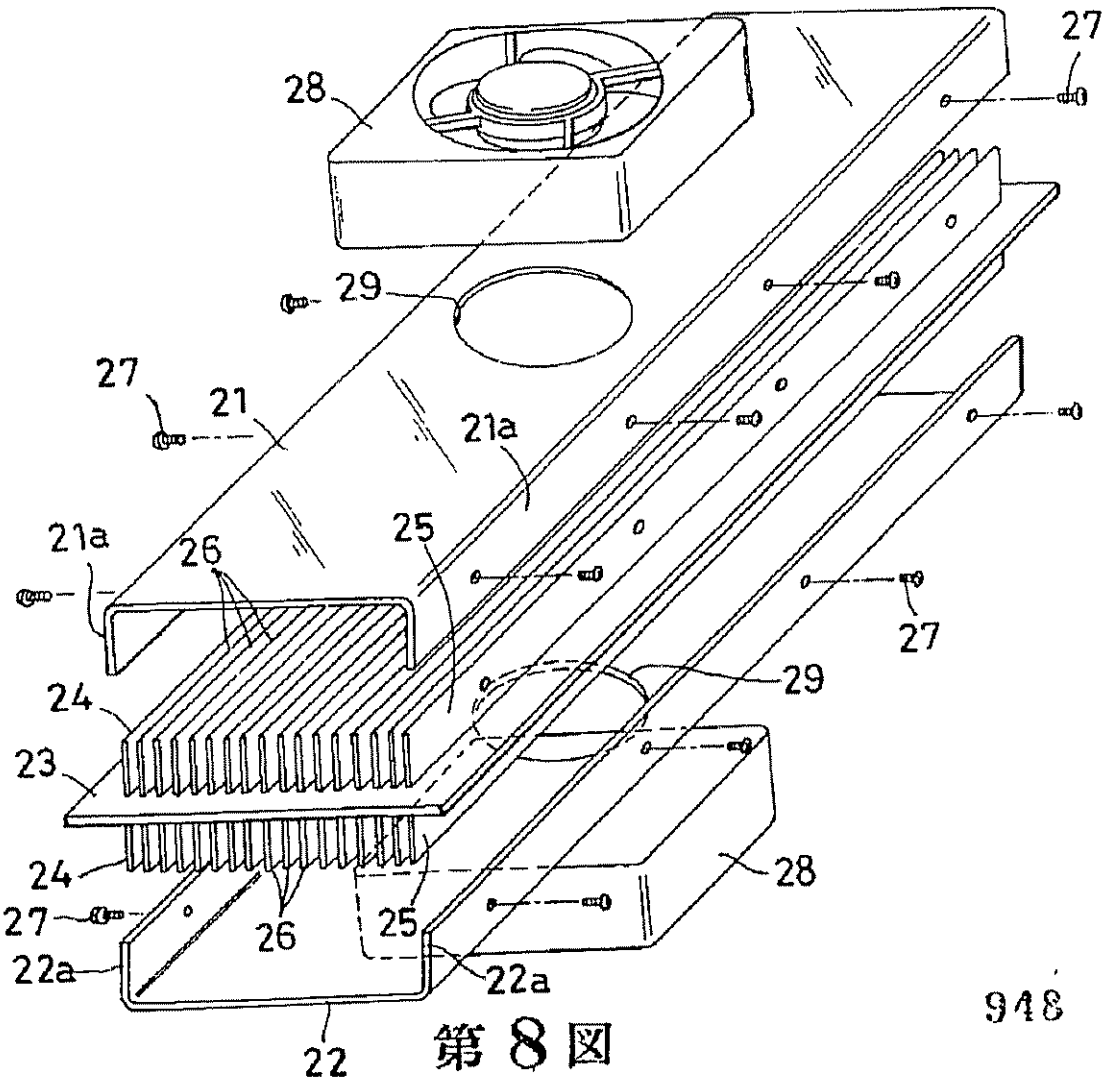
代理人 弁理士 畠本 瑛之助 ・外4



第 7 図



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第 8 図

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OSTRANS, LLC

CERTIFICATION

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It represents an accurate and complete English translation of the original Japanese-language document to the best of our ability and belief.

Robert G. Sellin
October 15, 2004

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(22) Date of Filing: April 1, 1987

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Specification (3)

1. Title of the Invention

Heat Exchange

2. Claim

A heat exchanger comprising a tubular frame (2) of extrusion-molded aluminum and a divider plate (3) having fins (4) on both sides thereof; wherein fitting grooves (7) and (7) are provided to the internal opposing surfaces of both the left and right of the tubular frame (2) so as to extend along the entire length of the tubular frame (2) from the opening at one end thereof to the opening at the other end thereof; the left and right edge portions of the finned divider plate (3) are fitted into the fitting grooves (7) and (7) on the internal surface of the tubular frame (2), and two fluid channels (11) and (12) are formed via the finned divider plate (3) inside the tubular frame (2).

3. Detailed Description of the Invention

Technological Field of the Invention

The present invention relates to a heat exchanger mounted in, for example, a sealed control panel and the like.

Prior Art

[The temperature of] the cubicle in a sealed control panel that contains a thyristor or other semiconductor element used to control an electric motor generally increases due to internal heat loss, but since this type of semiconductor has a fixed maximum allowable temperature, the heat must be dissipated to cool the internal components. Cooling the inside with outside air is the simplest and most effective way to dissipate heat, but contaminants are included in the outside air, so the contaminants adhere to the control device when this air is taken in, and there is a risk of compromising insulation properties. A heat exchanger is therefore desired that is capable both of completely isolating the inside of the cubicle from the outside air and of effectively performing heat exchange.

FIG. 8 depicts a known example of this type of heat exchanger, which is composed of a pair of substantially U-shaped covers (21) and (22) having a shallow transverse cross section, and a molded aluminum divider plate (23) having upright walls (24) and (25) to the left and right

on both sides thereof, and also having parallel fins (26) between the walls; wherein the walls (21a), (21a), (22a), and (22a) on both the left and right sides of the covers (21) and (22) are attached by screws (27) to the upright walls (24) and (25) on the left and right sides of the divider plate (23), respectively, whereby two fluid channels enclosed by the pair of covers (21) and (22) and partitioned by the divider plate (23) are formed. Intake fans (28) and (28) are positioned facing the intake holes (29) and (29) formed in the center of the inside cover (21) and the outside cover (22), respectively. This type of heat exchanger is designed such that one of the fluid channels is installed on the inside of the sidewall of the control panel cubicle, and the other fluid channel is installed on the outside thereof, clean air inside the cubicle is introduced from the intake hole (29) by the action of the two fans (28) and (28), the air is passed through the inner fluid channel and is caused to circulate inside the cubicle, and outside air is introduced from the other intake hole (29) and is caused to pass through the outer fluid channel, whereby the heat retained by the clean air inside the cubicle is transmitted to the outside air via the divider plate (23) equipped with the fins (26) and is caused to dissipate.

However, this type of conventional heat exchanger has drawbacks in that it has an extremely large number of constituent parts, is not easy to manufacture, involves high costs, and is heavy, and when the heat exchanger is attached to the sidewalls of a control panel cubicle for a long period of time, warping occurs in the sidewalls.

Objective of the Invention

An object of the present invention is to overcome the abovementioned drawbacks of the prior art and to provide a heat exchanger that has excellent heat exchanging performance, is lightweight, has an extremely small number of parts, and can be manufactured easily and at low cost.

Structure of the Invention

The essence of the present invention for achieving the abovementioned object resides in a heat exchanger composed of a tubular frame of extrusion-molded aluminum and a divider plate having fins on both sides thereof; wherein fitting grooves are provided to the internal opposing surfaces of both the left and right of the tubular frame so as to extend along the entire length of the tubular frame from the opening at one end thereof to the opening at the other end thereof; the left and right edge portions of the finned divider plate are fitted into the fitting grooves on the

internal surface of the tubular frame; two fluid channels are formed via the finned divider plate inside the tubular frame.

Working Examples

The present invention will next be described based on working examples. In the present specification, FIG. 5 is referenced from left to right, with "left" being the front side of the paper surface in FIG. 5, "right" being the back side thereof, "inner" being the inside of the cubicle of the sealed control panel, and "outer" being the outside of the same.

In FIGS. 1 through 5, which depict a working example in which the present invention is applied to the radiator of a sealed control panel, the heat exchanger (radiator) (1) of the present invention is composed of a tubular frame (2) of extrusion-molded aluminum that is substantially rectangular in its transverse cross section, and of a divider plate (3) having numerous ligulate fins (skive fins) (4A) formed so as to open towards the front and back surfaces of the frame. A pair of ridges (6) and (6) parallel to each other and fitting grooves (7) and (7) between the ridges are provided to the internal opposing surfaces of both the left and right sidewalls (5) and (5) opposite each other in the center of the width thereof so as to extend along the entire length of the tubular frame (2) from the opening at one end thereof to the opening at the other end thereof. The abovementioned finned divider plate (3) is inserted from the opening at one end of the tubular frame (2) so that both the left and right ends thereof fit into the fitting grooves (7) and (7) inside the tubular frame (2), and two fluid channels (11) and (12) are formed via the finned divider plate (3) inside the tubular frame (2).

Intake holes (9) and (9) are each opened at the center of both the inside and outside of the walls (8) and (8) of the tubular frame (2), and fans (13) and (13) are attached by screws (not shown) to the inside and outside of the walls (8) and (8), respectively, so as to face the intake holes (9) and (9).

Mounting overhanging walls (10) and (10) are provided to the external surfaces of the left and right sidewalls (5) and (5) of the tubular frame (2) at the center of the width thereof so as to extend outward and along the entire length of the tubular frame (2). Both ends (3a) and (3a) of the divider plate (3) have no fins (4A) and protrude outward from the openings at both ends of the tubular frame (2). Gaskets (14) and (14) made of urethane foam are attached to the surfaces of the mounting overhanging walls (10) and (10) of the tubular frame (2) and to the surfaces of both ends (3a) and (3a) of the divider plate (3) that face the control panel cubicle (15). Numerous

screw insertion notches (16) are provided to the right and left mounting overhanging walls (10) and (10) of the tubular frame (2) at prescribed intervals in alignment with the gaskets (14), and screw insertion holes (17) in alignment with the gaskets (14) formed at both ends (3a) and (3a) of the divider plate (3).

As shown in FIG. 5, the aforementioned heat exchanger (1) is installed in a state of close contact with the cubicle (15), such that the part of the inner fluid channel (11) is fitted into the opening (19) formed in the sidewall (18) of the control panel of the cubicle (15). The inner fluid channel (11) of the heat exchanger (1) is connected to the inside of the cubicle (15), and when the pair of inner and outer fans (13) and (13) operates, the clean, hot air inside the cubicle (15) is drawn in by the inner fan (13) from the intake hole (9) in the center of the inner wall (8) of the tubular frame (2), this air is passed through the inner fluid channel (11), and during this operation the retained heat is transmitted to the numerous ligulate fins (4A) and to the divider plate (3). The low-temperature outside air is also drawn in by the outer fan (13) from the intake hole (9) in the center of the outer wall (8) of the tubular frame (2), and is passed through the outer fluid channel (12), and during this operation the heat retained in the clean air inside the cubicle (15) is transmitted to the outside air via the divider plate (3) and the ligulate fins (4A). Cooled clean air whose heat has been released is caused to circulate in the cubicle (15) from the openings at both ends of the inner fluid channel (11), and the heated outside air that has instead taken this heat is dissipated to the outside from the openings at both ends of the outer fluid channel (12).

Because a configuration is adopted in the abovementioned working example whereby the heat exchanger (1) is composed of a tubular frame (2) of extrusion-molded aluminum and a divider plate (3) having numerous ligulate fins (4A) formed so as to open towards both surfaces of the frame, the number of parts is low, they can be manufactured easily and inexpensively, and the heat exchanger has excellent heat exchanging performance and is lightweight.

FIG. 6 depicts a modification of the finned divider plate (3) of the heat exchanger (1) of the present invention. In this arrangement, the divider plate (3) is made of an aluminum bracing sheet, and so-called multi-entry corrugated fins (4B) and (4B) having angled portions in a zigzag shape as viewed in a plane are joined on both sides of the plate. Also, the divider plate (3) is made of an aluminum bracing sheet, and the corrugated fins (4B) and (4B) are made by pressing an aluminum plate, so the divider plate (3) equipped with fins (4B) of this modified example is extremely light.

FIG. 7 depicts another modification of the finned divider plate. In this arrangement, the divider plate (3) and the parallel fins (4C) provided on both surfaces thereof are both made from extrusion-molded aluminum.

The finned divider plates (3) of the modifications shown in FIGS. 6 and 7 can be combined with the tubular frame (2) of the aforementioned working example made from extrusion-molded aluminum and can be configured in the same manner as the heat exchanger (1).

It is apparent that the shape of the fins (4) provided to both surfaces of the divider plate (3) is not limited to the shape shown in the figures and may have another shape. The tubular frame (2) shown in the diagrams is also substantially rectangular in transverse cross section, but may also have a cylindrical, elliptical, or other shape in transverse cross section.

The above working example was described with reference to a case in which the heat exchanger of the present invention was used as a radiator on a sealed control panel, but this is not the only possible option, and the present invention can be adapted to various other heat exchangers.

Effect of the Invention

As described above, the heat exchanger of the present invention is composed of a tubular frame (2) of extrusion-molded aluminum and a divider plate (3) having fins (4) on both sides thereof; wherein fitting grooves (7) and (7) are provided to the internal opposing surfaces of both the left and right of the tubular frame (2) so as to extend along the entire length of the tubular frame from the opening at one end thereof to the opening at the other end thereof; the left and right edge portions of the finned divider plate (3) are fitted into the fitting grooves (7) and (7) on the internal surface of the tubular frame (2); two fluid channels (11) and (12) are formed via the finned divider plate (3) inside the tubular frame (2). Therefore, the heat exchanger has an extremely small number of parts, its manufacture is easy and inexpensive, and the heat exchanging performance is excellent. Another advantage is that an extremely lightweight option can be obtained by using a divider plate (3) in which the fins (4) are ligulate fins (4A) or corrugated fins (4B) formed so as to be open on both sides.

4. Brief Description of the Drawings

The drawings depict the working example of the present invention, and FIG. 1 is an perspective view of the product of the present invention; FIG. 2 is a partial cut-away side view; FIG. 3 is a plan view of the same; FIG. 4 is a front view of the tubular frame alone; FIG. 5 is a partial cut-away side view depicting the product of the present invention in use; FIG. 6 is a partial perspective view depicting a modification of the finned divider plate; and FIG. 7 is a partial perspective view depicting another modification of the same. FIG. 8 is a schematic perspective view depicting the conventional example.

(1): heat exchanger

(2): tubular frame

(3): divider plate

(3a), (3a): end portions of divider plate

(4), (4A), (4B), (4C): fins

(5), (5): left and right sidewalls

(7): fitting grooves

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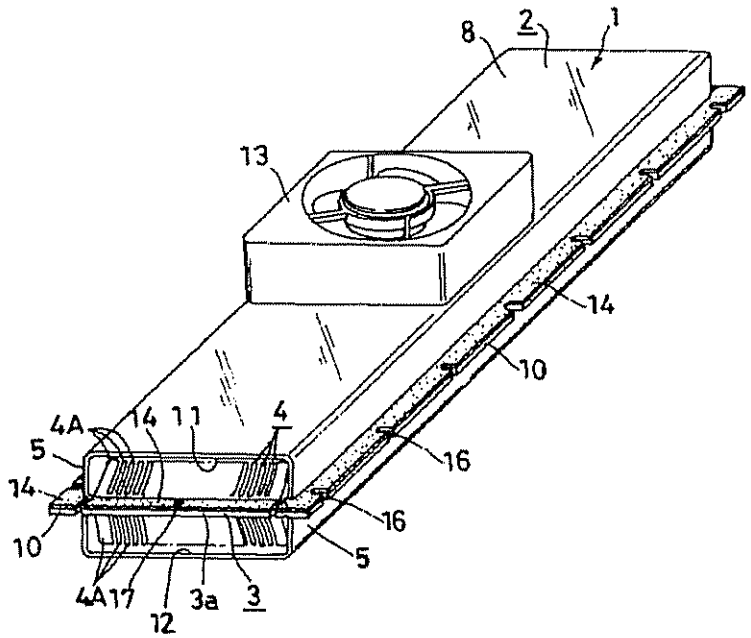
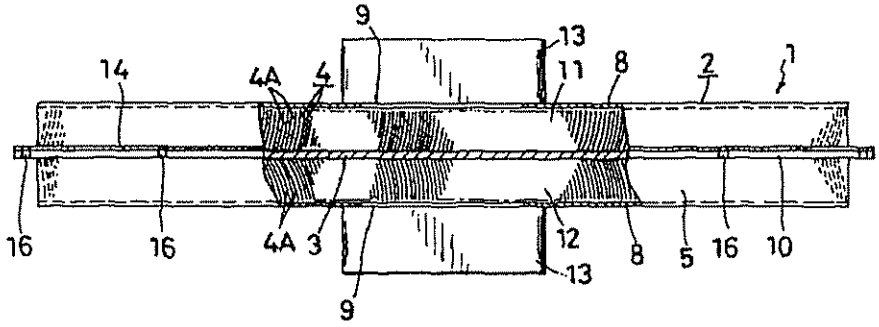
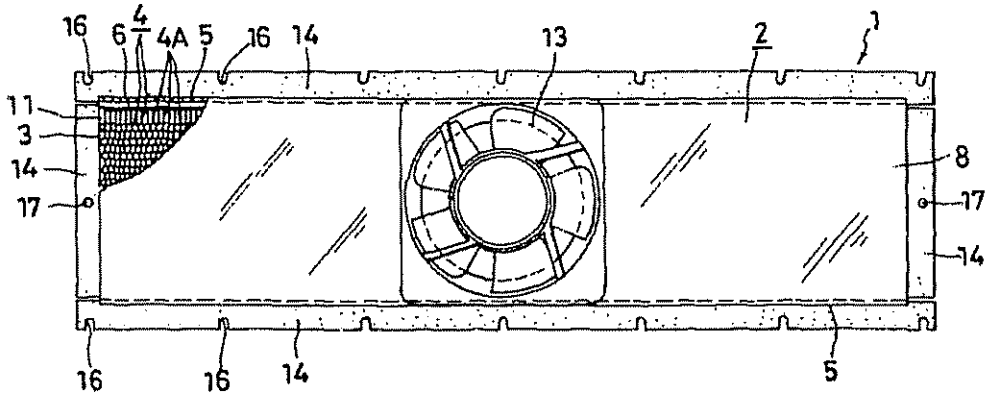
[FIG. 1]



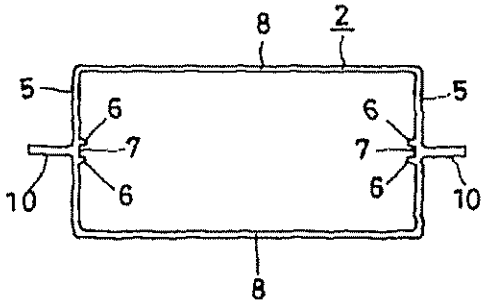
[FIG. 2]



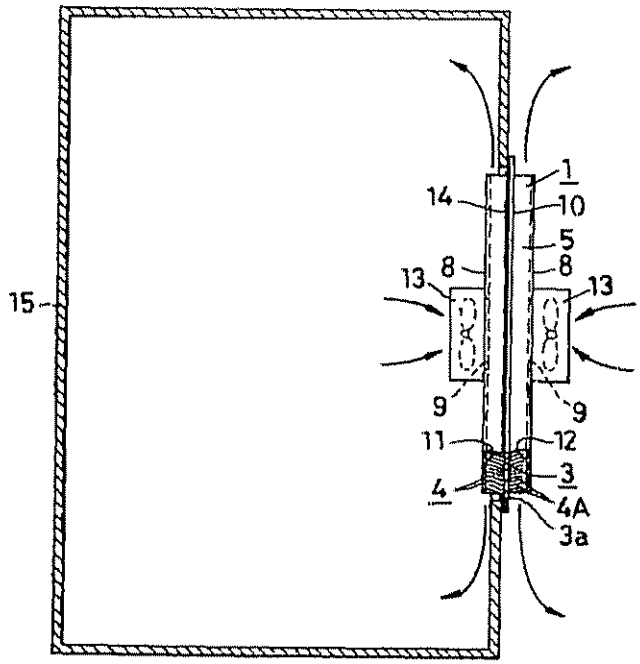
[FIG. 3]



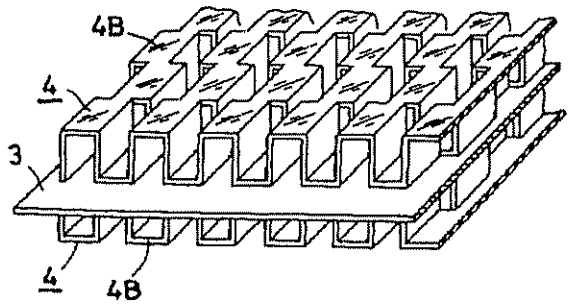
[FIG. 4]



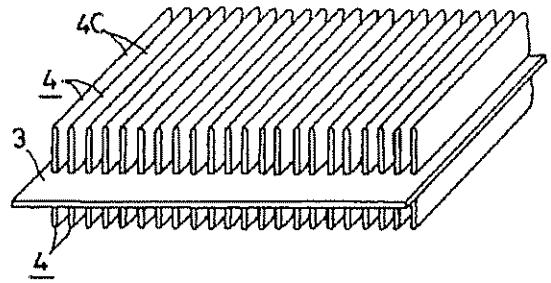
[FIG. 5]



[FIG. 6]



[FIG. 7]



[FIG. 8]